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TITLE: Artificial illumination of ornamental water fountains with color blending in response to musical tone variations

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U.S. PATENT DOCUMENTS

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PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
3387782	June 1968	Mizuno	362/96
4088880	May 1978	Walsh	362/96

ART-UNIT: 223
PRIMARY-EXAMINER: Lechert, Jr.; Stephen J.
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ABSTRACT:

An ornamental water fountain is artificially illuminated by separate sets of differently colored lamps illuminated by a color blending system that responds to variations in musical tones. In one embodiment, there are three sets of lamps in separate principal colors, namely, red, blue and green, and the intensity of light from each set of lamps is independently controlled during the playing of a musical number, producing a multitude of different colors reflected by the fountain in response to variations in the amplitude and frequency of the musical tones. The color blending

system operates in response to an input voltage representative of musical tones produced over a wide range of audio frequencies from a phonograph, tape player, radio receiver, or the like. The input voltage is separately coupled to low pass, band pass and high pass filters for producing separate frequency band signals representative of the content, i.e., combined amplitude and frequency, of the musical tones produced within low, intermediate and high frequency ranges, respectively. The three frequency band signals are fed to separate phase control circuits for independently adjusting power supplied to the different sets of lamps, thereby adjusting the intensity of the lamps in proportion to the content of sound produced within each frequency range.

10 Claims, 4 Drawing figures

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TITLE: Artificial illumination of ornamental water fountains with color blending in response to musical tone variations

Abstract Paragraph Left (1):
An ornamental water fountain is artificially illuminated by separate sets of differently colored lamps illuminated by a color blending system that responds to variations in musical tones. In one embodiment, there are three sets of lamps in separate principal colors, namely, red, blue and green, and the intensity of light from each set of lamps is independently controlled during the playing of a musical number, producing a multitude of different colors reflected by the fountain in response to variations in the amplitude and frequency of the musical tones. The color blending system operates in response to an input voltage representative of musical tones produced over a wide range of audio frequencies from a phonograph, tape player, radio receiver, or the like. The input voltage is separately coupled to low pass, band pass and high pass filters for producing separate frequency band signals representative of the content, i.e., combined amplitude and frequency, of the musical tones produced within low, intermediate and high frequency ranges, respectively. The three frequency band signals are fed to separate phase control circuits for independently adjusting power supplied to the different sets of lamps, thereby adjusting the intensity of the lamps in proportion to the content of sound produced within each frequency range.

Brief Summary Paragraph Right (6):
Briefly, this invention comprises a color blending system for artificially illuminating an ornamental water fountain that produces a water display pattern. Separate sets of lamps illuminate the water display pattern, and each set of lamps has a different color combination. In one embodiment, the lamps are illuminated by a color synchronization system that responds to a system input signal representative of sound produced over a range of audio frequencies. The system input can be signals from an audio system, such as a tape player, phonograph, stereophonic receiver, or the like. A frequency filtering circuit responds to the system input signal for producing a plurality of frequency band signals each being representative of the content of sound produced within a different audio frequency range. The content of the sound can be a composite of the amplitude ard frequency variations of the sound within each frequency range. The intensity of light produced by each set of lamps is varied in response to the magnitude of a corresponding frequency band signal.

Brief Summary Paragraph Right (7):
In one embodiment, the magnitude of the frequency band signals varies in proportion to the amplitude of the sound within each frequency range. In addition, the magnitude of the frequency band signals varies in relation to frequency of the sound within each frequency range. Each frequency band signal is coupled to a separate power control network for controlling power to each set of lamps in proportion to the magnitude of each frequency band signal. This adjusts the intensity of light from each set of lamps in proportion to the loudness and frequency variations of sound within each frequency range, and produces color blending that provides a visually effective representation of the accompanying musical number.

Detailed Description Paragraph Right (13):
In the system illustrated in FIG. 3, the light intensity of the lamps in each group is adjustable independently of the lamps in the other groups. The lamps in each group are connected in parallel so that all lamps in each group have essentially the same intensity as the light intensity is being adjusted. Each set of lamps is associated with a different frequency range of the musical tones being produced, and the content of sound within each frequency range is used to provide control over the intensity of

the lamps associated with that particular frequency range. In the illustrated circuit, the red lamps are associated with the low frequency components of the musical sound, the green lamps are associated with an intermediate frequency range or mid-range component of the musical sound, and the blue lamps are associated with high frequency components of the musical sound. Thus, as the content of sound within the low frequency range increases, the intensity of the red lamps increases; as the content of musical sound within the high frequency range decreases, the intensity of the red lamps correspondingly decreases, and so on. This arrangement of colors versus frequency ranges is used for example only, since other combinations of colors and frequency ranges can be used without departing from the scope of the invention. The term "content" of the musical sound is described below.

Detailed Description Paragraph Right (14):
Generally speaking, the color blending system of FIG. 3 respond to left and right system input signals L and R from the left and right channels of an audio amplifier. These input signals are buffered by first and second amplifiers A1 and A2, respectively. The system input signals can be the output from a stereophonic amplifier of a tape, phonograph, or radio receiver system playing a musical number. The left and right system input signals are summed by a summing amplifier A3 to form a composite output signal 102 representative of the sound produced over a range of audio frequencies, in this instance approximately 40 to 20,000 Hz. The composite, output signal is simultaneously applied to three filters, namely, a high pass filter 104, a band pass filter 106 and a low pass filter 108. The high pass filter includes amplifiers A4 and A5 for amplifying signals within a range of relatively high audio frequencies. The band pass filter includes amplifiers A6 and A7 for amplifying signals within a relatively intermediate range of audio frequencies. The low pass filter includes amplifiers A8 and A9 for amplifying signals within a relatively low range of audio frequencies.

Detailed Description Paragraph Right (15):
The high pass, band pass and low pass filters produce output signals 110, 112 and 114 representative of the content of musical sound within the high, intermediate and low frequency ranges, respectively. The output signals from the high pass, band pass and low pass filters are coupled to separate identical lamp intensity controls circuits 116, 118 and 120, respectively, also referred to as high frequency, mid-range, and low frequency phase controllers. The phase controllers are coupled to respective sets of the lamps for illuminating the water display pattern of the fountain. In the illustrated embodiment, the phase controllers 116, 118 and 120 are coupled to the sets of blue, green and red lamps, respectively. Each phase controller generally comprises a control circuit for controlling the amount of electrical energy or power supplied to the lamps as a function of the content of the output signals from the respective filters. The amount of power supplied to the lamps controls the illumination characteristics, as described below.

Detailed Description Paragraph Right (16):
To generally describe operation of the color blending system, it should be appreciated that a musical work can be converted to electrical signals by means of microphones in a live performance, or by means of stereophonic amplification equipment in the case of pre-recorded works. These electrical signals provide the left and right channel system input signals L and R and are used to energize respective sets of colored lamps via the phase controllers. For example, high frequency sound, produced by brass instruments, is amplified and passed by the high pass filter 104, the output of which energizes the high frequency phase controller 116, thereby controlling illumination of the lamps coupled to that phase controller. Low frequency sound produced, for example, by bass instruments, is amplified and passed by the low pass filter, which provides an output that controls illumination of the lamps coupled to the low frequency phase controller 120. Sound in the intermediate frequency range is passed by the band pass filter which produces an output that controls illumination of the lamps coupled to the mid-range phase controller.

Detailed Description Paragraph Right (17):
Coupling the output of each filter to respective phase controllers provides color blending of the light from the different sets of lamps, as described above, and such color blending is synchronized with the content of the accompanying music. The color blending relies on the content of the output signals from the filter circuits, and such content is characterized by both frequency and amplitude components of the musical sound in each frequency range.

Detailed Description Paragraph Right (28):

Thus, the band pass filter produces an output signal 122 that represents a composite of the amplitude and frequency of sound produced within the high audio frequency range passed by the high pass filter. The composite signal is fundamentally directly proportional to the amplitude of sound produced within the high frequency range. That is, the louder the sound within the high frequency range, the greater the output signal from the high pass filter. Superimposed on this fundamental signal is a frequency-dependent component having a magnitude directly proportional to the frequency of the sound within the high frequency range.

Detailed Description Paragraph Right (29):
The band pass filter produces an output signal 124 that represents a composite of the amplitude and frequency of sound produced within the intermediate audio frequency range passed by the band pass filter. The composite signal is fundamentally directly proportional to the amplitude of sound produced within the intermediate frequency range. Superimposed on the fundamental signal is a frequency-dependent component having a magnitude that rises in direct proportion to the frequency of sound within a beginning portion of the frequency range and levels off near the middle of the frequency range and then decreases in proportion to the frequency of sound within the later portion of the range.

Detailed Description Paragraph Right (30):
The low pass filter produces an output signal 126 that represents a composite of amplitude and frequency of sound produced within the low frequency range passed by the low pass filter, and this composite signal varies with amplitude and frequency in a manner similar to the output from the band pass filter.

Detailed Description Paragraph Right (36):
Thus, as an accompanying musical number is played, the voltage signals representing muscial tone variations in each frequency range are fed to corresponding phase controllers. The phase controllers illuminate each set of lamps in relation to the presence of sounds within each frequency range. The intensity of light from each set of lamps is increased in direct proportion to the amplitude of loudness of the sound in each frequency range. In addition, the intensity of light corresponding to each frequency range is varied in relation to frequency changes of sound in each range. That is, an increase in frequency of musical tones in the high frequency range causes a corresponding proportional increase in intensity of light produced by the sets of blue lamps. An increase in the frequency of musical tones over the intermediate frequency range causes a progressive increase, followed by a levelling off, followed by a progressive decrease in intensity of light from the sets of green lamps. Similarly, an increase in the frequency of musical tones over the low frequency range causes progressive increase, followed by a levelling off, followed by a progressive decrease in the intensity of light from the sets of red lamps.

CLAIMS:

1. A color blending system for artificially illuminated ornamental fountains comprising:

an ornamental fountain for producing a liquid display pattern;

separate sets of lamps for the liquid display pattern, each set of lamps being of a different color combination;

audio signal means for producing a system input signal representative of sound produced over a range of audio frequencies;

means responsive to the system input signal for producing a plurality of separate frequency band signals each representative of the content of sound produced within a corresponding different audio frequency range; and

control means for controlling the intensity of light produced by each set of lamps in response to a corresponding frequency band signal.

2. Apparatus according to claim 1 in which each frequency band signal has a magnitude proportional to the amplitude of sound produced within said corresponding audio frequency range.

3. Apparatus according to claim 1 in which the magnitude of each frequency band signal also varies as a function of the frequency of sound produced within said corresponding

audio frequency range.

5. Apparatus according to claim 1 in which there are at least three sets of such lamps; in which the means for producing the frequency band signals comprises high pass, band pass and low pass electrical filter means for producing output signals representative of sound produced within high, intermediate and low frequency ranges, respectively; and in which the output of each electrical filter means is coupled to a respective set of lamps.

6. Apparatus according to claim 1 in which the audio signal means produces two separate audio input signals; and including a mixing circuit responsive to both audio input signals for producing a composite system input signal representative of sound produced over said range of audio frequencies, said means for producing the frequency band signals being responsive to said composite system input signal.

7. Apparatus according to claim 3 in which the magnitude of such a frequency band signal varies in direct proportion to the frequency of sound within the corresponding audio frequency range.

8. A color blending system for artificially illuminated ornamental fountains comprising:

an ornamental fountain for producing a liquid display pattern;

first, second and third sets of lamps for illuminating the liquid display pattern, each set of lamps being of a different color combination;

audio signal means for producing a system input signal representative of sound produced over a range of audio frequencies;

low pass filter means responsive to the system input signal for producing a first frequency band signal having a composite magnitude proportional to the amplitude of sound produced within a low audio frequency range and variable as a function of the frequency of sound within the low frequency range;

band pass filter means responsive to the system input signal for producing a second frequency band signal having a composite magnitude proportional to the amplitude of sound produced within an intermediate audio frequency range and variable as a function of the frequency of sound within the intermediate frequency range;

high pass filter means responsive to the system input signal for producing a third frequency band signal having a composite magnitude proportional to the amplitude of sound produced within a high audio frequency range and variable as a function of the frequency of sound within the high frequency range;

first lamp control means for supplying power to the first set of lamps in proportion to the magnitude of the first frequency band signal for adjusting the intensity of light produced by the first set of lamps;

second lamp control means for supplying power to the second set of lamps in proportion to the magnitude of the second frequency band signal for adjusting the intensity of light produced by the second set of lamps; and

third lamp control means for supplying power to the third set of lamps in proportion to the magnitude of the third frequency band signal for adjusting the intensity of light produced by the third set of lamps.

10. Apparatus according to claim 8 in which the magnitude of each frequency band signal is directly proportional to the frequency of sound within the corresponding frequency range.